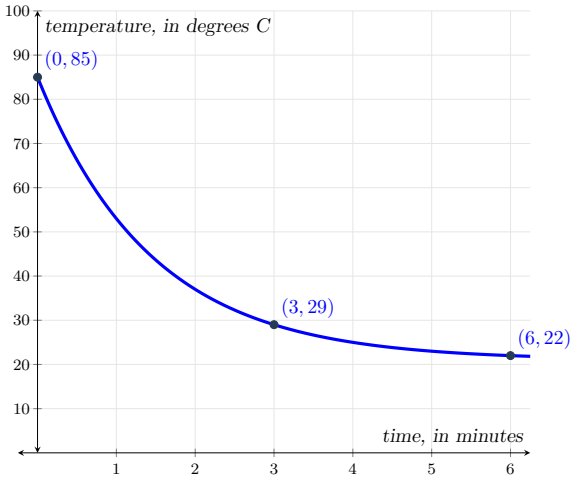
Part 1

Linear Equations

LE1.tex

Exercise 1 *The graph below shows the temperature T, in degrees Celsius, of an object at time t, in minutes.*



(a) *Based on the graph above, is this object heating up or cooling down?*

Multiple Choice:

(i) *Heating Up*

(ii) *Cooling Down* ✓

(b) *What is the rate of change in this data between the point corresponding to $t = 0$ minutes, and the point corresponding to $t = 3$ minutes?* $\boxed{-56/3}$ *degrees Celsius/minute.*

Hint: *Recall that the rate of change between two data points is given by* $\dfrac{\Delta T}{\Delta t}$.

(c) *What is the rate of change in this data between the point corresponding to $t = 3$ minutes, and the point corresponding to $t = 6$ minutes?* $\boxed{-7/3}$ *degrees Celsius/minute.*

(d) *Based on the your answers above, does this data always have the same rate of change?*

Multiple Choice:

(i) *Yes*

(ii) *No* ✓

`LE2.tex`

Exercise 2 *A table of data is given below.*

x	y
0	2
1	5
2	8
5	

(a) *The rate of change from the top row to the second row is:* $\boxed{3}$.

(b) *The rate of change from the top row to the second row is:* $\boxed{3}$.

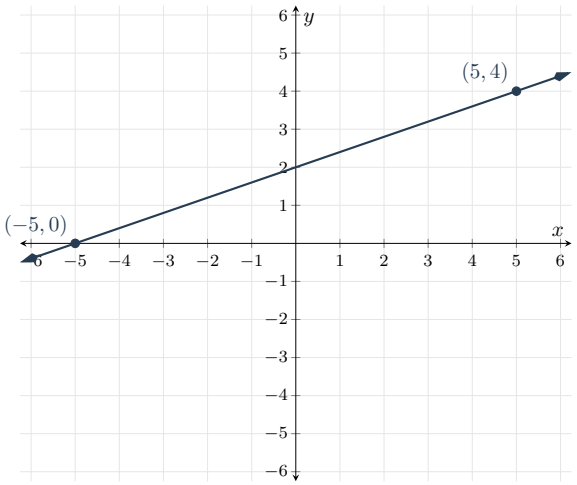
(c) *If this rate of change is maintained, whenever the x-value of a data point increases by* 1*, the y-value of the data point must increase by* $\boxed{3}$.

(d) *If this rate of change is maintained, whenever the x-value of a data point increases by* 3*, the y-value of the data point must increase by* $\boxed{9}$.

(e) *If this rate of change is maintained, the x-value* 5 *corresponds to the y-value* $\boxed{17}$.

(f) *An equation that describes the pattern in the table is* $y = \boxed{3x + 2}$.

`LE3.tex`



Exercise 3

(a) *The slope of this line is*

Multiple Choice:

(i) *positive because y is increasing* ✓
(ii) *positive because y is decreasing*
(iii) *negative because y is increasing*
(iv) *negative because y is decreasing*

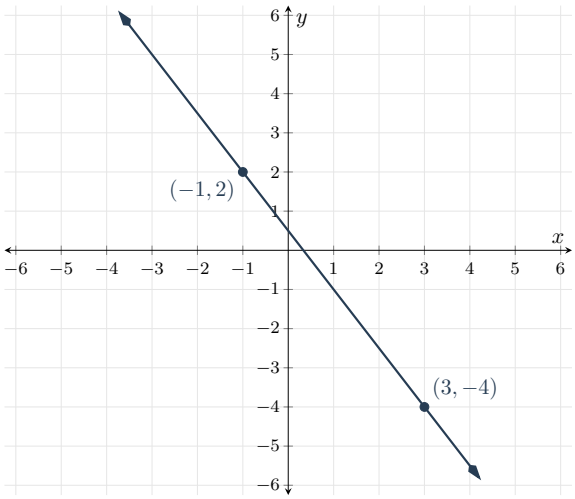
(b) *The slope of this line is* $m = \boxed{2/5}$.

Hint: *Recall that the slope of the line is the rate of change between any two data points on the line,* $m = \dfrac{\Delta y}{\Delta x}$.

(c) *The y-value of the point corresponding to $x = 9$ is* $\boxed{28/5}$.

Hint: *How much y increases if x increases by 1? How much does y increase if x increases by 4?*

`LE4.tex`



Exercise 4

(a) *The slope of this line is*

Multiple Choice:

(i) *positive because y is increasing*
(ii) *positive because y is decreasing*
(iii) *negative because y is increasing*
(iv) *negative because y is decreasing* ✓

(b) *The slope of this line is* $m = \boxed{-3/2}$.

Hint: *Recall that the slope of the line is the rate of change between any two data points on the line,* $m = \dfrac{\Delta y}{\Delta x}$.

(c) *The y-value of the point corresponding to $x = 0$ is* $b = \boxed{1/2}$.

(d) *The point-intercept form of the equation of this line is* $y = \boxed{-3/2}\,x + \boxed{1/2}$.

(e) *The point-slope form of the equation of this line is* $y - 2 = \boxed{-3/2}\left(x - \boxed{-1}\right)$.

(f) *The equation of this line in standard form* $\boxed{3}\,x + \boxed{2}\,y = 1$.

`LE5.tex`

Exercise 5 *A particular car is known to have a fuel efficiency of 32 miles/-gallon (mpg).*

(a) *If this car is driven 32 miles, it uses* $\boxed{1}$ *gallons of fuel.*

(b) *If this car is driven 96 miles, it uses* $\boxed{3}$ *gallons of fuel.*

(c) *Call x the number of miles driven and y the gallons of fuel used. Then x and y have a linear relationship.*

(i) *The slope of this linear relationship is* $\boxed{1/32}$ *gallons/mile.*

(ii) *The equation of this line in slope-intercept form is given by* $y = \boxed{(1/32) * x + 0}$.

`LE6.tex`

Exercise 6 *Vertical Lines*

Vertical lines do not have a slope. They consist of all points with the same x-coordinate. For example, the linear relationship with data given in this table consists of points with x-coordinate equal to 5.

x	y
5	-1
5	0
5	1
5	2

Since this line does not have a slope, we can not express its equation in either point-slope or slope-intercept forms. Instead, a vertical line has an equation of the form $x = C$, where C is the common x-coordinate between all the points, meaning that the line given in the table above has equation $x = 5$.

(a) *The line given by the following table of data:*

x	y
2	-3
2	1
2	1
2	3
2	5

has equation given by $x = \boxed{2}$.

(b) *The line given by the following table of data:*

x	y
$-3/4$	-8
$-3/4$	-7
$-3/4$	-6
$-3/4$	-5

has equation given by $x = \boxed{-\frac{3}{4}}$.

LE7.tex

Exercise 7 *Parallel lines*

> *Remember that two lines in the plane are parallel if they never intersect. This means that they are each traveling in the same direction. Any two vertical lines are parallel. Any two horizontal lines are parallel. Two non-vertical lines are parallel if and only if they have the same slope.*

(a) *Suppose a line has equation* $y = 3x + 4$. *An equation of the line parallel to this line, with y-intercept at* $(0, -2)$ *is given in slope-intercept form by* $y = \boxed{3}x + \boxed{-2}$.

(b) *Suppose a line has equation* $x = -2$. *An equation of the line parallel to this, which passes through the point* $(4, 2)$ *has equation* $x = \boxed{4}$.

(c) *Suppose a line has equation* $5x + 2y = -4$. *An equation of the line parallel to this, which passes through the point* $(2, -3)$ *is given in point-slope form by* $y - \boxed{-3} = \boxed{-5/2}\left(x - \boxed{2}\right)$.

LE8.tex

Exercise 8 *Perpendicular lines*

Remember that two lines in the plane are perpendicular if the intersect at a right-angle, of 90°. Any vertical line is perpendicular to any horizontal line. Two non-vertical lines are perpendicular if and only if their slopes multiply to -1. That is, if the slope of the first line m_1 and the slope of the second line m_2 have $m_1 m_2 = -1$.

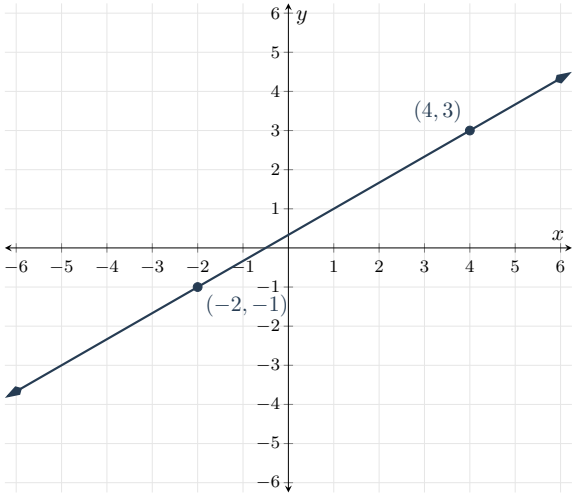
(a) *Suppose a line has equation $y = 3x + 4$. An equation of the line perpendicular to this line, with y-intercept at $(0, -2)$ is given in slope-intercept form by* $y = \boxed{-1/3}\,x + \boxed{-2}$.

(b) *Suppose a line has equation $x = -2$. An equation of the line perpendicular to this, which passes through the point $(4, 2)$ has equation* $y = \boxed{2}$.

(c) *Suppose a line has equation $5x + 2y = -4$. An equation of the line perpendicular to this, which passes through the point $(2, -3)$ is given in point-slope form by* $y - \boxed{-3} = \boxed{2/5}\left(x - \boxed{2}\right)$.

`LE9.tex`

Exercise 9 *The graph of a line is given below.*



(a) *The line parallel to this graphed line, which passes through the point $(3, 1)$ has equation in point-slope form given by* $y - \boxed{1} = \boxed{2/3}\left(x - \boxed{3}\right)$.

(b) *The line perpendicular to this graphed line, which passes through the point $(-2, 3)$ has equation in slope-intercept form given by* $y = \boxed{-3/2}\,x + \boxed{0}$.